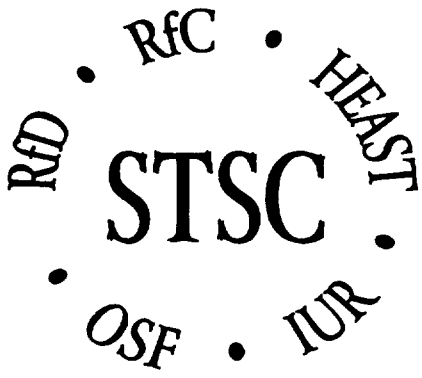
179964



Superfund Technical Support Center

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June 4, 2003

Dr. Milton Clark
U.S. EPA - Region V

ASSISTANCE REQUESTED: Requested a review of the document, *Sources of PCB to the Kalamazoo River–PCB Composition Information. (Kalamazoo River).*

ENCLOSED INFORMATION: Attachment 1: **Review of *Sources of PCB to the Kalamazoo River–PCB Composition Information.***

If you have any questions regarding this transmission, please contact the STSC at (513) 569-7300.

Attachments (1)

cc: STSC files

Supported by IntelliTech Systems, Incorporated, under
U.S. Environmental Protection Agency Contract No. 68-C-01-147.

Attachment 1

Review of *Sources of PCBs to the Kalamazoo River–PCB Composition Information*

Reviewed and approved by the STSC

June 4, 2003

Prepared by:

Syracuse Research Corporation
Syracuse, New York

Prepared for:

Superfund Health Risk Technical Support Center
National Center for Environmental Assessment
U.S. Environmental Protection Agency
Harlal Choudhury, Director
Cincinnati, Ohio

Review of *Sources of PCB to the Kalamazoo River - PCB Composition Information*

As requested, we have reviewed the March 20, 2003 report, *Sources of PCB to the Kalamazoo River-PCB Composition Information*, prepared by Dr. Mark Brown of Blasland, Bouck and Lee, Inc. (BB&L). Our review is focused on the following question: Is the information presented in the document technically correct and sufficient to support conclusions that other sources of PCBs clearly exist other than PCBs resulting from paper recycling? In general, the document presents a more comprehensive account of quantitative information that Dr. Brown has used to support his conclusion that sources of PCBs other than PCBs from paper recycling have contributed to PCBs in sediments within the Kalamazoo River Superfund Site than the KRSG document, *Sources of PCBs to the Kalamazoo River*, which was previously reviewed by SRC. However, as discussed below the conclusion is not sufficiently supported and other interpretations are possible.

Dr. Brown argues that non-paper recycling sources of PCBs (which used Aroclor 1254 or 1260 instead of Aroclor 1242) are significant contributors to current PCB levels in Kalamazoo River fish. Key to his arguments are measurements from 1993 (presented in Figures 8, 9 and 10 of the first set of figures in Section 2 and Figures 3 and 6 of the second set of figures in Section 2) showing that:

1. low ratios of specific trichlorobiphenyls to specific penta- or hexachlorobiphenyls ("A:G" or "A:K" ratios, respectively) reflect the composition of Aroclor 1254, whereas high A:G and A:K ratios reflect Aroclor 1242;
2. fish samples from Morrow Lake (upstream of the Superfund Site) show low average A:G and A:K ratios;
3. fish samples from Bryant Mill Pond (located on the Allied Paper, Inc. Bryant Mill property along Portage Creek) showed high average A:G and A:K ratios; and
4. fish samples from various locations along the main river channel (and in impoundments downstream from Portage Creek) show intermediate average ratios of trichlorobiphenyls to penta- or hexachlorobiphenyls.

Dr. Brown calculated predicted A:G and A:K ratios that would correspond to exposures to a 50:50 mixture of Aroclor 1242 and Aroclor 1254. Because the average A:G or A:K ratios of the fish sampled in the main river channel and in several impoundments downstream of the KRSG locations hovered above and below these predicted ratios, but were distinctly above the observed average ratios for Morrow Lake fish and below the observed average ratios for Bryant Mill Pond fish, Dr. Brown estimated that roughly half of the PCBs found in Kalamazoo River fish are derived from Aroclors not expected to have been used in paper recycling (i.e., Aroclors 1254 and 1260).

We agree that the 1993 fish data show that, on average, the A:G or A:K ratios in Bryant Mill Pond suckers were greater than the ratios in suckers from the main river channel and the downstream impoundments, which, in turn, were greater than those in upstream Morrow Lake suckers. We also agree that, if the fish were all of the same age, one plausible explanation of the A:G and A:K ratio data is that the PCBs in fish sampled from the main river channel and impoundments downstream of Portage Creek could have come from a mix of paper-recycling sources that used Aroclor 1242 and other sources that used Aroclor 1254 or 1260. We also agree that the anecdotal accounts of probable releases of Aroclor 1254 or 1260 into the Superfund Site from

upstream locations and from locations within the site add qualitative supporting evidence that PCB contamination within the site may not be solely from paper-recycling sources.

However, the complexity of the many biological and physical processes that can influence the distribution and transformation of PCB congeners in river systems and in fish tissue make quantitative predictions of the source of PCBs based on congener analysis of fish tissue highly uncertain. A key part of the problem is that penta- and hexachlorobiphenyls are not completely specific for Aroclor 1254 or 1260 and are detected in Aroclor 1242, albeit at lower concentrations. Fate and transport processes for PCBs in the flowing river channel may be different from that in Bryant Mill Pond and could lead to an overall enrichment of penta- and hexachlorobiphenyls, and a depletion of trichlorobiphenyls, in the fish tissue relative to whatever Aroclor mixture was originally added to the system. For example, the higher water solubility of the trichlorobiphenyls, relative to the penta- or hexachlorobiphenyls, could impart a greater relative short-term bioavailability of the trichlorobiphenyls but also lead to relatively faster transport of trichlorobiphenyls out of the site. Lower chlorinated congeners such as triclorobiphenyls are more readily metabolized than penta- or hexachlorobiphenyls by microorganism, plants, and fish. Other factors may also influence the distribution of PCB congeners in the tissue of fish from the three locations (Bryant Mill Pond, the river, and Morrow Lake) including the types of food available to the fish, the amount of sediment present in the water column, and the amount of time the fish spent in sediments. Taken together, the complexity of the processes makes source attribution from the fish data alone difficult.

Acceptance of Dr. Brown's conclusion requires sufficient evidence of the following criteria:

1. *A:G or A:K ratios in any given medium (sediment, water column, fish tissue) reflect relative abundances in Aroclor1254 and 1242.* This appears reasonable given the congener profiles of Aroclor 1242 and 1254, even given the overlap in the two congener profiles.

2. *A:G or A:K ratios in fish reflect the A:G or A:K ratios in their environment.* A:G or A:K ratios were not reported for sediment samples collected in Morrow Lake, Bryant Mill Pond, and the various location in the river channel. However, sediment samples were analyzed by the Aroclor method which relies on statistical pattern recognition and assignment to relative abundances of Aroclors. As discussed in the KRSG document, PCBs in sediment collected from "operable units" in 1993/1994 were mostly quantified as Aroclor 1242 (98% versus 2% Aroclor 1254/1260) and are expected to be the same as the sediment in Bryant Mill Pond, and PCBs in Morrow Lake sediments (collected in 2000) were quantified as 100% Aroclor 1254/1260. In these two environments, the A:G and A:K ratios of fish reflect the apparent PCB composition of sediments. In the river channel, however, the A:G and A:K ratios in fish did not reflect the apparent PCB composition of sediments (all samples collected between 1993 and 2000). The sediment samples indicated an average 83% Aroclor 1242 and 17% Aroclor 1254/1260 composition, whereas the A:G and A:K ratios in the river channel fish were consistent with 50% Aroclor 1242 and 50% Aroclor 1254. The KRSG document explains this lack of "reflectance" as being due solely to the preferential accumulation in fish tissue of congeners from Aroclor 1254/1260, but does not acknowledge that some of the congeners assigned to Aroclor 1254 in the fish tissue could have come from Aroclor 1242.

3. *A:G or A:K ratios in the environment reflect the respective ratios of PCB loadings to the environment.* Evidence for this criterion appears to be lacking for the river channel. Although the correspondence of the fish and sediment data provides support for this criterion in the relatively static pond environment, fate and transport processes in the river could have altered the ratio at different rates than in the pond. These processes include dissolution of low-chlorinated PCB congeners, preferential sorbtion of higher-chlorinated PCBs to particles, chemical transformations, volatilization, resuspension, burial, scouring, and water flow.